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Final Technical Report

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Title: Small-Scale Structure in the Interstellar Medium
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Using the LWP camera at high dispersion on the *International Ultraviolet Explorer* (*IUE*) satellite, we obtained observations in 1989 September and October of the interstellar Mg I, Mg II, Fe II, and Mn II absorption toward both components of the resolvable binary stars κ CrA, 57 Aql, 59 And, HR 1609/10, 19 Lyn, and θ Ser in the first step of an effort to probe the small-scale structure of the diffuse interstellar medium (ISM). These binaries have projected linear separations ranging from 5700 to 700 AU. Except for κ CrA, the strengths of the interstellar absorption lines toward both components of these binaries agree to within 10%. In the case of κ CrA, the optically thin interstellar Mg I and Mn II lines are ≈50% stronger toward κ^2 CrA than κ^1 CrA. We obtained higher resolution optical observations of interstellar Ca II which show that this difference is concentrated in the main interstellar component at $v_{LSR}=9\pm2$ km s^{-1}. Interestingly, this velocity corresponds to an intervening cloud that may be associated with the prominent Loop I shell in the local ISM. Given the separation (23") and distance (120 pc) of κ CrA, the line strength variations indicate that this cloud has structure on scales of 2800 AU or less. The only other sightline that has been found to exhibit structure on this scale is that of HD 72127 through a filament of the Vela supernova remnant. The homogeneity in our other sightlines contrasts with several recent studies which find significant ISM structure on much smaller (≈25 AU) and much larger (≈0.1 pc) scales. These results were presented at the 1990 meeting of the American Astronomical Society in Albuquerque and have been published in the *Astrophysical Journal (Letters)* (reprint enclosed).

The second step of our effort was designed to follow up these results with *IUE* LWP observations of other binaries capable of probing ISM structure at larger scales and high galactic latitudes as well as examining further the Loop I region. We obtained 2 US2 shifts of observations in 1990 June of the interstellar Mg I, Mg II, Fe II, and Mn II absorption toward both components of the resolvable binary stars κ Lup, 17 Dra, and μ Cru. Due to scheduling difficulties, the remaining 2 US2 shifts worth of observations were only recently carried out (1992 March) and included the binaries 36 Her, 61 Oph, and HR 890/1. Consequently, the final results of this part of the program are not in yet. However, toward the 3 binaries

that have been analyzed so far, it appears that the ISM is homogeneous down to the 10% level at the 1300-8500 AU length scales probed. This preliminary finding would be consistent with the bulk of the binaries in our earlier *IUE* sample.

Publications

Meyer, D. M. "Small-Scale Structure in the Diffuse Interstellar Medium" 1990, *Astrophysical Journal (Letters)*, **364**, L5.